FACTSHEET: LOCATING NEW PRIVATE WATER WELLS

INTRODUCTION

This factsheet provides basic information regarding proper location of new private water wells. Properly locating a drinking water supply well is one of the simplest ways to help assure a safe water supply. It is the well owner's responsibility to ask well drillers to construct domestic wells in appropriate locations. Incorrectly sited domestic water wells can be highly susceptible to contamination. Current land use should be taken into consideration when siting your well. When siting a new well, consider existing contaminant sources and possible expansions into currently undeveloped areas (additions to a house, barn or corral). *Note: this Factsheet does not include information regarding permits required for private water wells. Please contact the Wyoming State Engineer's Office (SEO) at (307) 777-6163.*

LOCATION

The first step in determining a proper location of a new well should be to find information on water wells in your area. The SEO has information on permitted wells across the state, copies of water well records in your area can be found by searching the SEO **e-Permit Database**. Using the legal description of your property, you can obtain drilling logs of wells in your area that may help identify potential water bearing zones. This information will help in estimating the depth and cost of your well. Drillers familiar with your area are also a valuable source of information. In addition, assistance in determining the occurrence and depth to water bearing zones can be obtained by a professional geologist, well contractor, or the Wyoming Geological Survey, **Water Resources Division**.

The cost of having good professional assistance prior to drilling a new well may be far less than the cost of repairing or reinstalling a poorly designed or located well.

The distance between your well and a potential source of contamination is called a setback. These distances provide a margin of security for your well, should some accident or spill occur. The suggested setback distances vary depending on the contaminant and local subsurface conditions. Minimum acceptable setback distances are provided in the ***Setback Distances Factsheet***.

Groundwater flow direction is an important consideration when siting a new well. In general, groundwater in water table aquifers flows in the same direction as surface water flow; therefore, topographically high locations may be protected from groundwater contamination. However, groundwater flow directions do not always correspond to surface water flow directions (i.e. ground surface topography). This becomes extremely important in water table aquifers near streams, where groundwater flow direction can change due to effects of seasonal high-water flows. Seasonally high and low stream levels should be considered when evaluating groundwater flow direction in water table aquifers near streams.

Whenever possible, wells should be located at high points on your ranch/farm to prevent surface water runoff being channeled towards topographic lows and into the wellhead area. New wells should also be located up-gradient from any potential sources of contamination. Potential sources of contamination on typical ranches and farms are identified in the

Contaminant Sources Factsheet. Also, you should site a new well away from your property boundary (toward the center of your lot) so that you have control over the land uses in the area surrounding your well.

HYDROGEOLOGY

The availability and movement of water in the subsurface is controlled by many factors. Some of these factors include: physical characteristics and slope of the water bearing formations, depth to water, recharge area, and ground surface slopes. Obtaining these types of information before drilling will improve the likelihood of drilling and developing a productive well.

Aquifers are water bearing formations composed of unconsolidated (loose) materials, consolidated rock or a combination of both materials. Unconsolidated materials range from loose gravel, to sand, silt or clay. Consolidated formations (**Figure 1)** can consist of sandstone, shale, granite, and many other rock types. Groundwater moves in consolidated aquifers in much the same way as it moves through unconsolidated aquifers, such as gravel. Open spaces, such as pores or fractures, can transmit water at varying rates. The pore space in consolidated sandstone may transmit adequate amounts of water for your well; however, highly fractured sandstone or limestone may transmit many times that amount of water. The decisions about what formation your well will be completed in can affect how much water your well can supply.

Aquifers can be classified as unconfined, confined **(Figure 2) or semi-confined**. Unconfined aquifers are water table aquifers that are at atmospheric pressure. Confined aquifers are overlain by an impermeable layer, such as clay or shale, which prevents the upward or downward movement of water. An overlying confining layer allows aquifers to develop pressures that may result in artisan aquifers. Semi-confined aquifers are aquifers in which the confining layer is not completely impermeable.

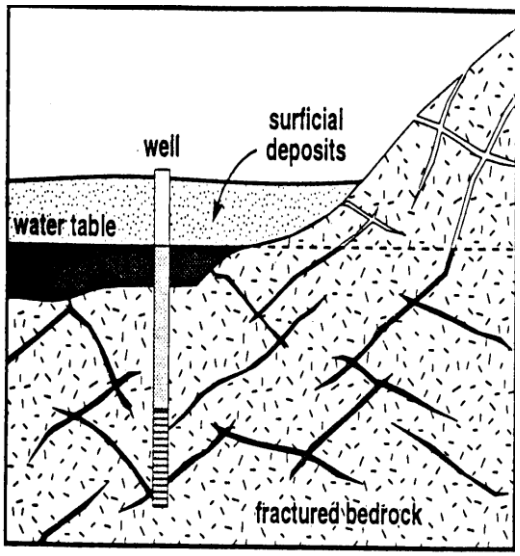

FIGURE 1.

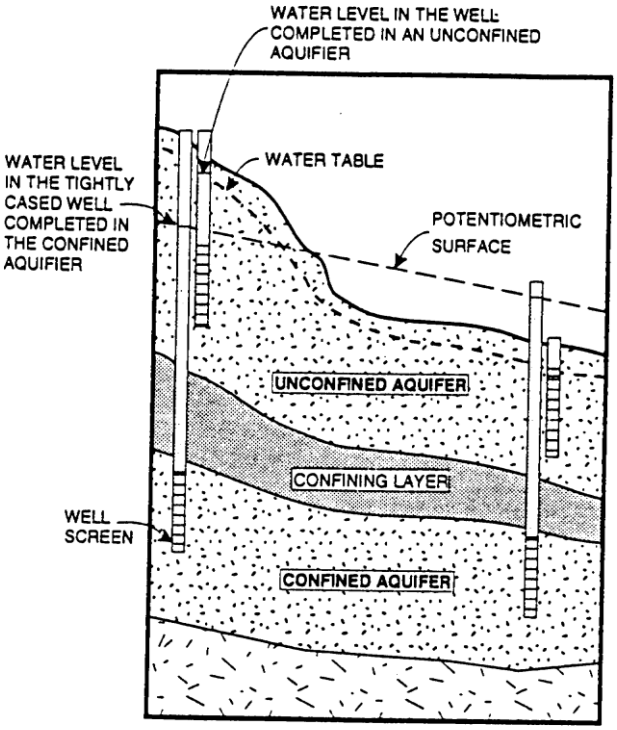

FIGURE 2.

SHALLOW WELLS

Many wells in Wyoming are in alluvial valleys, the lowlands next to streams and rivers. These shallow wells can be very productive and produce high quality water; however, shallow aquifers are the most vulnerable to pollution from surface activities. The depth to groundwater in many shallow wells is directly influenced by water levels in nearby streams, and can fluctuate several feet in response to seasonal stream changes. Seasonal variations can also cause water quality changes.

When drilling a well near streams or rivers during periods of high water levels, seasonal water table changes must be taken into account. The well screen must be long enough to allow for seasonal fluctuations. The well screen should be placed deep enough in the target waterbearing zone to avoid having the well go dry or avoid insufficient water yields during low water table conditions. For example, shallow wells next to agricultural lands can show drastic water table rises during irrigation periods. Well screen depth should be designed to prevent the impacts from agricultural practices such as the application of fertilizers or pesticides during irrigation periods. The well design should include casing and sealing material (bentonite or concrete grout) to prevent surface water and shallow groundwater from seeping down alongside the outside of the well casing and contaminating deeper groundwater supplies. A well located next to an irrigation ditch, sub-irrigated land, or a subsurface tile drain system may have a high potential for contamination from agriculture applications of pesticides and herbicides. Additional information on these topics are presented in the ***Contaminant Sources*** and ***Well Construction Factsheets***.

DEEP WELLS

Deep wells are more costly to drill than shallow wells and present additional difficulties in assessing the subsurface aquifer conditions and the chances of encountering adequate water quantities. Costs for deep wells increase due to increased drilling difficulty, additional labor and material costs, and increased pump size requirements. The drilling method chosen can significantly increase or decrease the time to reach the desired depth of the well. Care must be taken during well construction to prevent water from undesirable shallow aquifers from entering the deep well. Poor quality water from aquifers shallower or deeper than the target aquifer can reduce the overall water quality of the well. Properly casing, completing and developing the well can prevent this from occurring. It is recommended that guidance be obtained from a professional geologist, well contractor, or the Wyoming Geological Survey, **Water Resources Division** on the construction design of deep wells.

WELL CONSTRUCTION METHODS

Drilled water wells have distinct advantages over other installation methods such as dug wells or driven well points, due to the quality of the finished well. Many drilling methods can be used; each has particular advantages and disadvantages depending on the depth of the well, formations to be penetrated, cost, speed, and other factors. Almost all drilling methods use water, air or some kind of drilling fluid to remove the rock fragments from the borehole. Care must be used if drilling fluids must be used to ensure that the drilling fluid will not contaminate your aquifer or present a problem with development of the finished well.

CONTACTS

Wyoming Department of Environmental Quality, Water Quality Division, (307)777-7781

Wyoming State Engineers Office, (307)777-6163

Wyoming State Geological Survey, (307)766-2286

U.S. Geological Survey, Water Resources Division, (307)778-2931

U.S. Environmental Protection Agency, Region VIII, 1-800-227-8917.

University of Wyoming Water Resources Data Center, (307)766-6651

DRINKING WATER QUALITY STANDARDS

U.S. Environmental Protection Agency's Safe Drinking Water Hotline. Call toll free 1-800-426-4791 from 8:30 A.M. to 5:00 P.M. Eastern Time.

WDEQ Know Your Well, Understanding Your Test Results website: deq.wyoming.gov/wqd/know-your-well/resources/understanding-your-results/

WATER QUALITY TESTING: LABORATORIES/INFORMATION

County Health Departments

County Extension Agents: www.uwyo.edu/uwe/county/

WDEQ Know Your Well, Find a Laboratory website: deq.wyoming.gov/wqd/know-your-well/resources/find-a-laboratory/

REFERENCES

Bouwer, H., *Groundwater Hydrology*, McGraw-Hill, 1978.

Driscoll, Fletcher G., *Groundwater and Wells*, 2nd. Edition, Johnson Division, St. Paul, MN, 1987.

Freeze, Allan R. and Cherry John A., *Groundwater*, Prentice-Hall, Inc., NJ, 1979.

USEPA Seminar Publication-*Wellhead Protection: A Guide for Small Communities,* US Government Printing Office, EPA/625/R-93/002, February 1993.